

Economic Implication of Power Outage in Nigeria: An Industrial Review

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Abstract

This work shows how poor power supply to industrial consumers has contributed to the increase of prices of consumer goods and services in Nigeria thereby affecting the standard of living and thus placing the average citizenry of the present day Nigeria in a pitiable condition. For the purpose of this research, relevant data was collated from various operators for a period of twelve months, the data was analyzed sequentially using spread sheet analysis and results were obtained. From the data it was established that the total monthly cost of generating power from the industry in question is ₦45,811,859. Further results show that if the power generated by the appropriate power utility is used, there will be a 30% reduction in the cost of generating power thus leading to a corresponding reduction in the prices of goods by the industry. The paper has therefore shown that increase in the cost of power generated often lead to a corresponding increase in the prices of goods and services.

Keywords: Generators, Maintenance, Kilowatt Hour, Power Supply, fuelling.

Introduction

The energy production level of any community dictates its pace of development and hence its poverty level. It is possible to alleviate poverty in developing countries through provision of alternative renewable energy. In Nigeria, more than 75% of the populations are rural dwellers. Less than 20% of Nigeria is connected to the National grid, and more than 70% of its population of about 140 million live in more than 80% of its land mass of Nigeria which is not connected to the national grid [1]. Production process in many companies in Nigeria are still tied to diesel and related energy supply whose cost implications often push operating profits to nil. This is because costs are difficult to manage at relatively high activity level of production driven by demand hence, leading to a high cost of goods and services. Though some companies are changing to compressed natural gas as an alternative source of

energy the question now remains: How many companies can afford the high cost of full acquisition installation and sustainability? [2]. The main objective of any power utility in a competitive environment would be to supply customers electrical energy as economically as possible with a higher degree of reliability and quality [3] but this is not so in Nigeria as many industries tend to rely on generators.

The Nigerian energy industry is probably one of the most inefficient in meeting the needs of its people hence, it has weakened the industrialization process and significantly undermined the effort to achieve sustained economic growth [4]. The Nigerian generating stations as of the time of writing this paper is predominantly gas fired which is pulverized by vandalism with gas flaring. It is in this wise that generating stations may not be able to meet up with the expected power availability. Most industries as shown in [5, 6] in Nigeria have thus resulted to alternative power supply using the diesel engine generators because it is the quickest way to supplement for the instability in power supply ironically. This has become their primary source of power while the electric utility industry has been placed on redundancy because of their poor reliability. Research [7] established that over 60million Nigerians rely on generator for power supply and as at 2006, over 60million generators were imported to the country with approximately ₦1.6trillion spent to fuel these generators. One can therefore imagine the amount of Carbon IV Oxide (CO₂) emitted into the environment from the operations. Studies have shown that CO₂ has shot to the top of the list of environmental concerns in developing countries as the source of anthropogenic climate change [8]. This paper therefore discusses how the effect of unstable power supply as well as high cost of fueling and maintaining these generators have tremendously increased the prices of goods and services in Nigeria. This work is organized into five parts viz: part 1 gives the Introduction, Part 2 gives a Brief Profile of the Nigerian Power Sector, Part Three contains the Research Methodology while results obtained are discussed in Part 4 and Part 5 gives the conclusion, recommendation and proposed future work.

The Nigerian Power Sector

Presently in Nigeria, the total installed capacity of the generating stations has not equate the energy demand of the people due to poor infrastructure and policies despite the government's increasing investments in this sector. Research [9] asserts that an annual investment of \$10 billion per annum would be required in the power sector over the next 20 years to achieve optimum power availability at optimum industrial and human capacity growth by the year 2030. This implies that more engineers will have to be integrated into policy making in the sector for the purpose of sustainability. Assuming the power availability in Nigeria was to hit 10,000MW, the question that arises is: Do we have a reliable transmission infrastructure in place to evacuate the power generated with ease to the distribution lines? The answer was provided by [10] who argued that the transmission system in Nigeria does not cover every part of the country and that it is technically weak with the capacity to transmit only a maximum of 4,000MW. At the distribution end of the sector protests as customers are depressed by the nature of epileptic power supply. Research [11] revealed a value of 25W per citizen be supplied on a daily basis based on availability. It is in this wise that industrial, commercial and residential consumers in the country result to making what is supposed to be a standby power source a primary source not minding the cost (particularly for the Industries) and vice versa. The industries therefore includes the cost of their maintaining and fuelling their generators in the prices of goods and services thereby making life difficult for the common man.

Methodology

The process (Brewery) industry used as a case study has a 3×2000kVA diesel fired generator with a power factor of 0.8 for each generator installed which gives a real power supply of 1600KW per generator. At any given instance, two generators are always on running mode at 50% loading capacity, while the third generator on standby is to be used whenever either of the running generators undergoes maintenance practices. Some equipment in the industry consuming the power generated are the air plant, CO2 plant, Cooling plant, steam plant, water plant, ammonia plant, pasteurizer and filler plant. The peculiarity and sensitivity of the production process requires the industry to carry its operations using the power from the generators only. Hence, doing away with the power utility companies due to their poor reliability.

Since the industry solely relies on these generators adequate maintenance is required for continuous power supply. Generally, 250hrs maintenance and 500hrs maintenance are carried out. The former requires the complete changing of the water separator, the fuel filter and cleaning the air filter and other parts of the generator while the later includes all activities of the former in addition to changing the oil filter as well as draining the used oil and filling the generator with new oil.

In order to be more comprehensive with this work, data used for the research was collated through direct interview of the operators, technicians and technologist as well as the supervisors on duty. Data was also collated from the daily

operational log book of the various operators on duty. Table 1 and 2 shows the maintenance cost and fuelling cost of the generators for 12 months.

At any given time it is always expected two out of the three plants must be running and at a 50% load capacity thus, it is expected for each of the generators to supply a real power of 800KW each hence, when this value is multiplied with 30days in a month taking cognizance of the fact that two generator should be on the running mode always then:

Table 1: maintenance item and their cost

S/N	ITEM	DESCRIPTION	QTY	AMOUNT(₦)	TOTAL(₦)
1	1R0756	ELEMENT AS	216	6,899.00	1,490,184.00
2	1R0726	ELEMENT AS	360	9,809.70	3,531,492.00
3	1346307	ELEMENT KIT	96	16,890.00	1,621,440.00
4	3E9840	DEO-C14-DRUM	64	132,800.00	8,499,200.00
5					15,142,316.00

Table 2: cost of fuelling generator

CONSUMPTION RATE	VOLUME CONSUMED (LITRE)	AGO COST PER LITRE(₦)	TOTAL COST (₦)
DAILY CONSUMPTION	11,000	135	1,485,000
MONTHLY CONSUMPTION	330,000	135	44,550,000
YEARLY CONSUMPTION	4,015,000	135	542,025,000

$$KWH \text{ FOR A YEAR} = KW \times \text{RUNNING HR OF THE GENERATORS} \quad (1)$$

$$= 8760 \times 1600$$

$$= 14016000 KWH$$

Cost of generating 1KW of electricity by the industry is thus given as:

$$1KWH = \frac{\text{TOTAL COST OF POWER GENERATION BY THE PLANTS}}{\text{TOTAL ENERGY PRODUCED DURING THE PERIOD}} \quad (2)$$

$$1KWH = \frac{₦}{KWH} \quad (3)$$

$$\text{Cost of 1KWH} = \frac{557167316}{14016000}$$

$$= ₦ 39.75$$

In order to determine the percentage change in price we have that:

$$x = \frac{100a}{b} \quad (4)$$

Where

x= is the percentage change in price

a= Assumed Cost of power sold by Power Utility

b= Cost of self-generation by the Industry

Discussion of Result

Table 1 and Table 2 have depicted the high cost of maintenance of power plant as well as the high cost of fuelling the plant. From the tables it can be found out that the amount

used in fuelling the plants as well as maintaining the generators monthly are ₦44,550,000 and ₦ 1,261,859 respectively. It can also be seen that the cost of generating 1KWH of electricity by the industry was approximately ₦40. But research [11] has shown that the cost of generating 1KWH of energy by the appropriate power utility industry in Nigeria is ₦12.20, and this power is eventually evacuated to the industrial consumer at ₦27.00 per KWH. The brewery as at the time of writing this research has been producing an average of 82,921 hectolitre of drink per month hence, if the cost of generating power in the industry is ₦45,811,859 and this amount is required to produce 82,921 hl of drink then it will require ₦552 to produce 1HL of the drink. But if the power generated were to be coming from power utility who sells power to industrial consumer at ₦27 per KWH then the cost of power would have reduced to ₦32,140,800 and this amount will equally produce the same quantity and quality of the drink that was produced for ₦45,811,859 thus requiring ₦387.6 to produce 1HL of the drink.

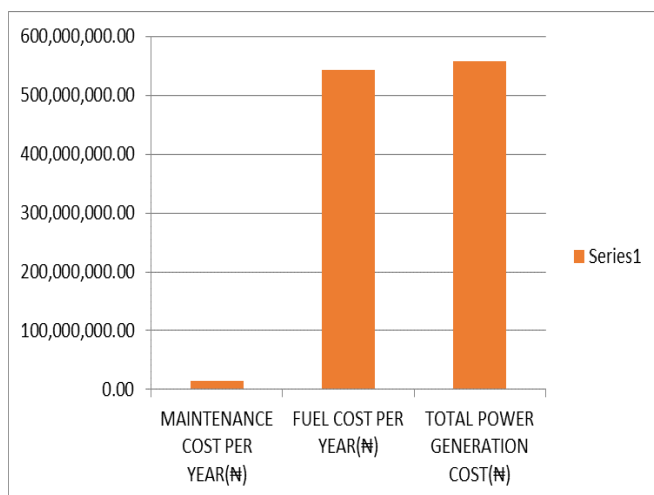


Figure 1: Graph Showing Maintenance, Fuel and Total Cost of Power Generated

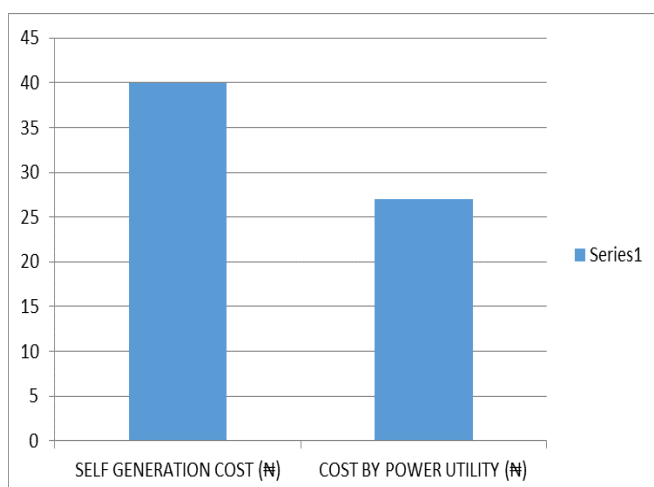


Figure 2: Graph Showing Cost of Generation by Self and by Power Utility

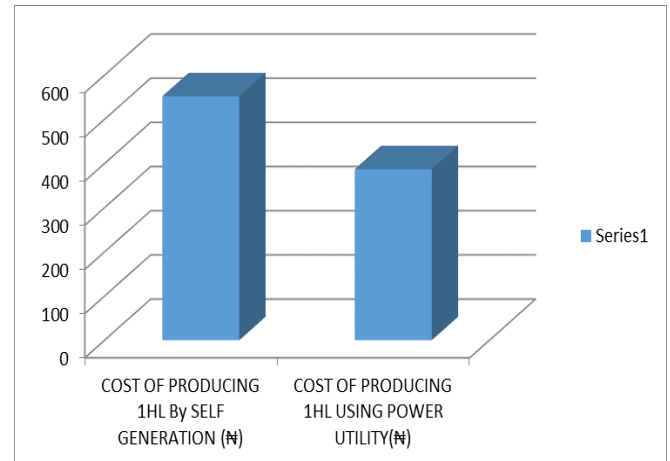


Figure 3: Graph showing the cost of producing 1HL of drink

Conclusion and Recommendation

This paper discussed the economic implication of high cost of generating power by industries in Nigeria. The results obtained showed that the high cost of maintenance and of fuelling the generators is one of the reasons for the high cost of goods. Thus, for the industries to make significant return on investment the prices of goods produced is therefore increased.

In order to achieve a reduction in price of goods it is strongly recommended that the appropriate authority makes power supply available to the industries in Nigeria. The industrial consumer on their own part should try as much as possible to adopt the maintenance culture used in the airline and aviation industries because research has shown that it would lead to a considerable maintenance cost saving during the life cycle of the plant without lowering and in most cases improving the reliability of the system [12]. Finally it was observed that the amount spent on fuelling the generators is quite enormous hence it is highly recommended that apart from introducing a compress natural gas (CNG) fired plant to the production company, they should also be thinking of building at least a 6MW generating plant to meet their energy demand. Research [13] asserts that it costs an average of \$1.2million (₦264,000,000) to build a 1MW power plant. This study has therefore shown that the amount used in generating power if extrapolated for the next three years is enough to build an excess of 6MW gas fired power plant such that the power not utilized by the industry can be sent to the grid or to the nearby communities as part of social responsibility using distributed generation scheme.

References

- [1] Akinboro, F.G, Adejumbi, L.A and Makinde, V. "Solar Energy Installation in Nigeria: Observations, Prospect, Problems and Solution". Transnational Journal of Science and Technology Vol.2, No.4, pp73-84.
- [2] The Punch Newspaper 25th May, 2015.

- [3] Oyedepo, SO. Fagbenle, RO. Adefila, SS. Adavbiele, SA. "Performance Evaluation and Economic Analysis of a Gas Turbine Power Plant in Nigeria" *Energy Conversion and Management* Vol. 79, pp 431-440, 2014.
- [4] Mbunwe, M.J. "Analysis of Energy Crisis and how it affects Production Sector and Economic Growth of Nigeria". *WCECS* vol. 1, 2014
- [5] Enebeli EE. "Casualty analysis of Nigerian Electricity Consumption and Economic Growth, 2010.
- [6] Asikhia, JO "Effect of Generator Usage on Small Scale Business in Nigeria" Bachelor's Thesis Tampereen University of Applied Sciences, 2014.
- [7] Energy Commission of Nigeria Annual Energy Report, 2012.
- [8] Tamba, JG, Njomo, D, & Mbog, E.T, "Assessment of CO₂ Emissions in the Petroleum Refining in Cameroon", *Universal Journal of Environmental Research and Technology*, 1, pp. 455-466, 2011.
- [9] Ibitoye, FI, Adenikinju A, "Future Demand of Electricity in Nigeria. *Applied Energy Journal* Vol. 84 No. 5 2007. pp 492-504
- [10] Aioboman, AE, Okakwu, IK, Amaize, PA, Oluwasogo, ES. "An Assessment of Voltage Instability in the Nigerian Power System Network". *IJES* Vol. 4, No. 7, pp 9-16, 2015.
- [11] <http://www.vanguardngr.com/2014/09/electricity-power-zero-transformation>
- [12] Peter, B "Application of RCM type Maintenance Methodology within Eskom Distribution. Eskom Distribution Technology, South Africa
- [13] Ugwu, HU, Nwakwojike BN, Ogbonnaya, E.A & Ekoi EJ "Energy and Economic Losses Due to Constant Power Outages in Nigeria. *NIJOTECH* Vol. 31, No 2, 2012.